

Case Study: Using Reading Comprehension Strategies with Math Story Problems

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Background Information

When placing sixth graders into their homeroom our students are organized by their End of Grade (EOG) test scores. We first look at their language art scores and then sort them by their math scores. Then we group them together by elementary school attended. Being a magnet school we have students from all over the county. Our students come from fifty-two different middle schools, and we find it important for our students to have at least one person in his or her class that he or she knows from the year before. My homeroom is one of the two sixth grade classes that are both honors math and honors language arts.

To place into double honors, a student had to have done extremely well on the fifth grade EOG. Most of my students fall into the top ten percent of the state in language arts and the top five percent in Math. At their elementary schools, my students were the top students. These are students that all schools want or hope to create. Most schools will have a few of these types of students, but at my school we have nearly fifty of them. Their reading level is their binding characteristic. All of my students are avid readers. It is a common request for me or another teacher to ask them to put their books down so that they can participate in class. I have even had students reading while walking the track during recess.

There are thirty-two students on my home base. Twenty-one of them are female, and eleven are male. Their lack of diversity academically is made up in the socioeconomic realm. I have students who are classified as homeless and students whose parents who are executives for Bank of America. My students were born on four different continents, they speak five different languages, and they practice at least four of the world's major religions.

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The student to whom I taught the two lessons required for this assignment is a major contributor to the diversity in my classroom. Sophia speaks English and is Caucasian. She is the older of two girls who lost their father when Sophia was in the third grade. All three ladies in the family have been living with the mother's boyfriend for the last two years. Sophia came from a small school that had a Talented and Gifted program. She very seldom raises her hand to participate in class, and if she has anything to say, she will tell me later in the day when the rest of the kids are not around.

This introversion does not help her academically. She is a member of a class of 32 students, and one of 125 students over all there is not many opportunities when the rest of students are not around. My design for this project is to outfit Sophia with the tools to read and comprehend story problems so that she does not have to wait for the opportunity and time to ask me a question. Even though Sophia and her classmates are advanced readers, their extremely high level of math leads me to introduce more complex math problems. Math problems already "are written above the (reading) grade level for which they are intended" (Metsisto, 2005). This higher reading level and irregular format found in math problems, makes it important to teach reading comprehension strategies.

Design of Case Study

"Good readers are active readers." (Duke, 2011)

The intent of my Case Study was to bring in language art practices that my students already have been taught and to make those practices applicable for a math class. The two lessons that I have selected were introduced to them earlier in the year by their language arts teacher. My intent was to take that prior knowledge of a reading strategy and have all of my

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students manipulate it in order to fit reading into math class. Both lessons followed the same format: reintroduce, practice with a reading passage, look for applications in math, and practice with math. My students are very comfortable with SQ3R and Graphic Organizers.

SQ3R , (Survey, Question, Read, Recite, and Review) students to look for text features and is a good fit for math class because math “text can contain words as well as numeric and non-numeric symbols to decode. In addition, a page may be laid out in such a way that the eye must travel in a different pattern than the traditional left-to-right one of most reading. There may also be graphics that must be understood for the text to make sense; these may sometimes include information that is intended to add to the comprehension of a problem but instead may be distracting.” (Metsisto, 2005)

Graphic organizer (Cluster Diagrams) was a good fit for Sophia because she already has strong organization skills and a graphic organizer would focus her to pull out the text feature. “Another important tool to support text structure instruction is the use of graphic organizers.” (Duke, 2011) “In a traditional reading paragraph, there is a topic sentence at the beginning and the remaining sentences fill in details that expand on and support this main idea; in a mathematics problem, the key idea often comes at the end of the paragraph, in the form of a question or statement to find something” (Metsisto, 2005). Metsisto goes on to explain that “students must learn to read through the problem to ascertain the main idea and then read it again to figure out which details and numbers relate to the question being posed and which are redundant” (Metsisto, 2005). Teaching my students to use the Graphic Organizer is a strategy to have them make sense of this unfamiliar text structure to find what is important.

Graphic Organizer Lesson

“An important part of teaching concepts is the use of graphic organizers. Such devices are designed to help students develop background knowledge and to grasp relationships among concepts. Their value is to make concepts more concrete, depict relationships, serve as an aid to memory, and use context to enhance learning” (Ehren, 2005)

I chose the graphic organizer to teach my student because it will enforce some of the qualities of a good reader: being active while reading, focusing on text structure, and using tools to aid in comprehension. (Standard VI) My goal is to strengthen reading strategies that Sophia already knows so that she can apply them to her math problems.

As stated above, the graphic organizer lesson was a lesson that was not new to my students. This is something that they had been taught in language art classes for the last two years. I used the graphic organizer lesson because of this familiarity, which my students will find comfortable and its application across content areas. (Standard II). The comfort that Sophia has with this method is evident in how completely and accurately she filled out the diagram that she had to do for homework. She was able to add bubbles to the organizer to fit her needs. I really like this style of graphic organizer and the flexibility that it gave my students while reading these two passages

Of the many reading comprehension strategies, graphic organizer was also chosen because it is “an important part of teaching concepts Such devices are designed to help students develop background knowledge and to grasp relationships among concepts. Their value is to make concepts more concrete, depict relationships, serve as an aid to memory, and use

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context to enhance learning” (Ehren, 2005) (Standard I). Sophia’s word splash shows how the graphic organizer aided her memory. Many of the points that were in her bubble showed up on the word splash even though it was a day later and she did not know that she was going to be assessed for comprehension on the reading. The graphic organizer is an easy way for students to put their thoughts together and to help with retention. I wish I had been using it in my math classes in years past.

The graphic organizer is also an easy fit into math class because of its flexibility. It can adapt for every size of story problem. To make the transition from a Language Arts reading comprehension strategy to a math strategy it has to be flexible. (Standard II). The lack of rigidity of the organizer is clear from the four different examples of reading that were given to Sophia. With the gorilla article and self-driven car article Sophia was able to add bubbles to fit her needs creating two different graphic organizers. When she was left to make her own diagram for the two math problems, neither organizer resembled the other: the prime desert one was very simple, and the other had three tiers. Having this freedom to organize data in math problems is indispensable because math problems can vary so much.

I introduced this topic during our sixth block class (Flex Time). This is a period that is built into the day so the other two grade levels in our school can fulfill International Bachelorette (IB) and the state of North Carolina requirements. In sixth grade, we use this flex time to prepare our students for middle school, to get our students comfortable with IB and to introduce classroom topics and projects. (Standard IV). This less structured period is an opportune time to introduce these new topics. The lack of formality aids in my students’ willingness to try new things knowing that it will not affect their math grades. This is apparent by Sophia’s willingness to color her word splash, and to put it in the shape of the sun. The word splashes that she has

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done in the past were not in this format. I liked the opportunity of introducing crossover topics in sixth block. My students were more open to explore because they were not trying to figure out how it was going to be asked on the next test.

I chose to start with the article on gorillas because I believed that my students would find it interesting. Having a class that has students from around the world and from different cultures, it is easy for my students to find international connections. We have a classmate who was born in a neighboring country of the ones talked about in this article. “Students’ motivation to read is also enhanced by providing contexts, materials, or tasks that catch students’ spontaneous attention or situational interest.” (Duke, 2011). My African student was able to make a connection to the article’s discussion of community involvement, and other students were able to make connections to this article from a show that they had seen on TV. (Standard III) I knew that my students would have been able to make connections to the article, but I also liked its ability to fit the graphic organizer.

This gorilla article also fit well with the graphic organizer template that we were using. The subtopics fit well into the secondary “bubbles” of the organizer. Each topic of each paragraph fit the second tier “bubbles” well letting us fill in the third tier with facts found in the sentences. (Standard III) The material from the article fit nicely into the graphic organizer. The class informed me that they needed to add one extra bubble to put “national parks” off of Central Africa, and that was a perfect teaching moment on how to work with graphic organizer. Next year when I introduce graphic organizers to my new student I will use this same article.

The homework assignment of reading the self-driven car was chosen because of the technology aspect of it. Sophia is very tech-savvy, and this article would be something that she

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would like to read about. Her level of interest would increase the likelihood that she would stay engaged throughout the reading and remember more about the article. It has been proven that “even after controlling for prior knowledge, students’ actual comprehension, as measured by recall, was much higher when students were reading on a topic of interest” (Duke, 2011). How complete Sophia’s diagram was shows me that she was engaged while reading the article. Also the car that she put into the word splash made it clear that this was an article that interested her.

The flexibility that the word splash brought was also attractive to me. This freedom to create increases the level of engagement in my students. The lack of formality of this assessment gave my students an opportunity to reach and explore and to try to write everything that they could remember. “A reader has to decide which techniques are most helpful in constructing meaning at a given point in time, before, during, and after reading.” (Duke, 2011). This was apparent given how many different things Sophia wrote that were not on her graphic organizer. I am going to use this word splash more often in math class to assess my students’ understanding of mathematical concepts.

It was not difficult for Sophia to be successful transitioning the graphic organizer from a language arts strategy to something that could be used on math story problems. When I prompted, “How would this cluster diagram look if we used it on a math problem?” the students’ suggestions for smaller and less-complex graphic organizers showed me that they had an understanding of the concept. This is evident in Sophia’s two math problems. The graphic organizers that she created are very simple with just a few bubbles.

They students were also to explain what information was needed for the center of the article. In the lesson plan for the graphic organizer you see that I asked, “What would be in the

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center of the diagram?” This led the class to draw its attention to this main part of the diagram, which is typically left for the title in a language arts class. This class discussion helped Sophia focus on looking for the main point of the story problem. In the “prime desert” question she put, “Find the prime desert that has the most numbers but all of the numbers are less than 50” which is the question of the problem. In the first question she wrote, “How do kids get to school?” This was the main point of the problem. This shows that she has an environment where she feels safe to try different things. (Standard IV) This also shows that graphic organizers are flexible enough to work with many types of problems (Standard V). In reflection I chose these problems because they would have enough information to fill a graphic organizer, but next time I would give more complex math problems. Sophia did not have to work very hard on the math in these problems.

Sophia got the two graphic organizer questions correct - all seven answers. She was aided in her responses to those problems by the organization of the diagram. (Standard V). A strong example of this is how she was able to shape her thought around the center question. She had information that was written into the problem: the definition of a prime desert, the example sequence, and the upper limit of fifty. She also included prior knowledge: the definition of a prime number and the strategy used to isolate prime numbers. Given enough time and the right student, the graphic organizer is a good way to sort through the confusion of a math problem.

SQ3R

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My hope with the SQ3R lesson is that it would focus on text structure. “Strong empirical evidence indicates that readers’ awareness of text structure is highly related to reading comprehension” (Ehren, 2005). As stated earlier in this paper, math text has its own unique structure. My students already had some experience with SQ3R in their language arts class. My hope was to have my students make the transition with this strategy from the language arts classroom to my math class (Standard VI). That is why I started off with the first article and then transitioned into the two story problems. Of all the reading comprehension strategies, this is the one that I found most useful.

The most powerful thing that SQ3R does for my readers is to give them a purpose while reading. “Setting purposes for reading . . . increases comprehension.” (Duke, 2011) (Standard II) You can see that Sophia was reading with a purpose because of all of the notes that she leaves for herself throughout both the Space Jump article and the two math problems. In the article you see that she labels all the pictures and questions the sub-headings. On the second math problem, she is underlining and questioning the purpose of the picture. I believe that is why she did so well with these assessments.

I chose the Space Jump article primarily because I had spoken of the topic with a few students when it happened earlier in the year. I also like the article because it lent itself well to SQ3R, with all of the captions and subheadings (Standard III). You can see by looking at Sophia’s article that she was able to Survey, Question, and Review. To survey, she looked at all the pictures, and throughout the article she had written questions that she came back and answered. This form of active reading shows that her level of engagement is high.

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I did the ten-question assessment to make a correlation between what the students saw in the text while they were reading to what they were able to answer a day later. In my SQ3R lesson plan, I asked for my students to look at the questions that they got wrong and see if they addressed it in their reading of the article. You can see that Sophia got question nine wrong. Question nine asks, “How long did he take to prepare?” and in her highlighting she did not highlight the part that talked about the five years the diver planned for the jump. I am not too worried about this misstep in regards to math. Math problems have less text to sift through and there are fewer facts to remember.

The SQ3R lesson that I created was successful in reminding Sophia about the steps to SQ3R. Going through each letter in SQ3R and having me students explain each step was an effective strategy by that it let me know who was familiar with each step and let the ones that did not remember everything about it, see it on the board again.

The SQ3R method was successful in getting Sophia to focus on the problem. You can see on both problems that she was questioning and underlining. This underlining and questioning, a part of SQ3R, drew out the textual features. “Good readers typically look over the text before they read, noting such things as the structure of the text and text sections that might be most relevant to their reading goals.” (Duke, 2011) You can see that in the second problem she previewed the radio, and questioned its importance. “To use text structure strategically to aid comprehension, students have to activate their metacognitive resources and ask themselves some key questions about text structure.” (Ehren, 2005) This focus led her to being successful on the math problems given to her.

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Sophia was able to get all the questions correct, even all of the Angie and Jim question. I had multiple students get the last problem incorrect. It asked if there was enough information to tell how many students were in the class. Sophia's attention to the text of the problem helped her in understanding what the question was asking. You can see with this problem that she is translating the bullet points into her own words. The effort that she took on the front end of the problem prepared her to solve the more difficult problems.

SQ3R also has the flexibility that the graphic organizer method had. You can see that Sophia is able to apply the method to both problems and have success at answering both. The Angie and Jim problem has two bullet points and the radio problem has the face of the radio to deal with to answer the problem. I feel since this was not a new strategy to Sophia, (Standard II) as she was able to make the transition seamlessly between the two formats.

Conclusion

It has been proven that "instruction that includes hands-on activities, opportunities to engage in reading for authentic purposes, and texts with a clear structure and vivid, concrete examples is associated with motivated engagement and, subsequently, better recall." (Duke, 2011). The two strategies, SQ3R and graphic organizers, written about in this paper are two strategies that give opportunity to engage readers to increase comprehension.

Sophia proved that these strategies could transfer over to a math class and be helpful. This transfer was possible because both SQ3R and graphic organizers are very flexible. They can be applied to many different types of math problems.

My next step, I need to continue with both of these methods. I need to keep having my students practice these strategies on story problems till it becomes second nature. "These

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practices should be implemented within a gradual release of responsibility model, incrementally turning over responsibility for meaning-making practices from teacher to student” (Duke, 2011)

Bibliography

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Graphic Organizer

Date: 11/26 -11/27

Duration: One 35 min 6th block class, One 55 min math class the next day

Objective(s) for today's lesson: The objective of today's lesson is to reintroduce reading strategies to my students. Have them get more practice with these strategies. Have my students apply this language art technique to math story problems.

Common Core Standards

6.RP.3c Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
5. Use appropriate tools strategically.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Rationale: “The students know how to do the math. They just don't understand what the question is asking.” (Miller, 2009) My students have difficulty solving story problems because they do not apply the reading skills to math class. Concept mapping helps with comprehension and should help with students' understanding of story problems.

Materials & supplies needed: Gorilla Story, Self-driven Car Article, two concept webs, Story problems.

• **Introduction to the lesson (20 min)**

I know that my students have experience with concept maps. I am asking these questions to see who knows what and to keep my students engaged. I am moving around the room calling on different students whether or not they have raised their hands. I am also restating what they have said to clarify.

Ask: “What do you all know about concept maps?” I am looking for an answer that says, “It helps us figure out what the article is about.” Ask: “When have you used concept maps, and why did you use them?” I am looking for some sort of answer that states when reading longer articles, to keep up with the information in the story. Put the image of the map that we will be using up on the document camera. Ask: “With this concept map how would we use it? What about this circle in the middle? What do we do with this next level of circles? I have always had a hard time with pre-made concept maps, like this one, because I don’t think that one size fits all. I do not like if there are not enough bubbles or too many.” Explain to them that this is just a rough template, and if they need to add or remove bubbles they should feel free to do that.

Now we are going to “get some more practice with concept mapping.”

• **OUTLINE of key events during the lesson**

6th Block

Pass out the Gorilla article, give to every table and give them time to read, should be about 5 min. At the end of 5 min, ask “who need extra time”. Do not worry about time. Walk around and survey the progress of the students, and once it looks like 90% are finished, inform them that “we are now going to fill out this concept map together. If you still need a little more time to read, please finish and you will be able to catch back up in a second.”

Project the concept web and ask: “What should go in the middle; what is the point of this article?” They should all say: “Gorillas!” Ask: “What was one major point about this article?” They should respond with one of these answers: extinction, Central Africa, family ties, increase in population - or something like these. Whatever point that they put forth, ask which bubble that it should be written in and proceed to fill out the third tier bubbles for that section

. Suggested cluster diagram: **going extinct:** disease, hunting, habitat loss. **Central Africa:** Rwanda, Uganda, D.R.C., national parks, and mountains. **Family Ties:** Silver back, large groups, interdependent, organized, become dependent on humans, multiple wives. **Increase in population:** conservation, community engagement.

Remind them that this is just a template; they can add or subtract bubbles if needed.

Gorilla Article and Diagram should take **(20 min)**

Have students read the Self-Driven Car Article for homework, and complete the graphic organizer.

1st block Math class

Pass out a blank sheet of paper, and suggest that they can have their colors out (markers, crayons, pencils).

Ask them to do a “Word Splash” about the self-driven car article. Point out that a Word Splash is like what we did for our favorite numbers that are posted out in the hall. They are not allowed to have the article out nor the graphic organizer. Tell them: “This is not for a grade. I just want to show you how much clearer you would remember the concepts in the article if you had organized them.” **(5 min)**

Give students time to create their word splash. **(15min)**

If students finish early, ask them to go back to the article to see what they could have written in. Do not let them add more to the word splash after looking back at the article. I want to make a comparison of the word splashes between the students that did the graphic organizer and the ones that did not.

Once the students have finished, ask them to share what they put in their word splash. Have them count the number of ideas that they put down and point out that the ones that had the higher number of ideas in their word splashes were the ones that actually did their graphic organizer and the ones who forgot had the lower number count. **(5 min)**

Ask: “How could creating graphic organizers help with story problems?” Look for responses like, “It would help us remember what is in the problem” and “Shows us how things are connected” and “It would help us make sure that we are not leaving anything out” and finally, “It would help us get organized.” **(5 min)**

Ask: “How would a cluster diagram look for a math problem? What would we want in the center of our cluster?” I am looking for my students to say the question; the thing we are trying to solve for in the problem. **(2 min)**

Pass out two math story problems and have them read the problems, create a cluster diagram for the problems and then solve the problems. Go over the math part of it. Collect the work to check for accuracy. **(rest of class)**

• **Closing summary for the lesson**

“How did creating a graphic organizer aid in solving this problem?”

“Would this work for every type of math problem?”

“For which type would it work best?” **(3 min)**

Assessment

I will be looking at the word splash to assess how much they comprehended from their reading of the Self- Driven Car article.

I will use the two story problems that I gave them to asses both their level of understanding of graphic organizers and of percentages and fractions

I will be looking for papers with developed graphic organizers and correct answers to the problems

SQ3R

Date: 11/27 -11/28

Duration: One 35 min 6th block class, One 55 min math class the next day

Objective(s) for today's lesson: The objective of today's lesson is to reintroduce reading strategies to my student. Have them get more practice with these strategies. Have my students apply this language art technique to math story problems.

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Mathematical Practices

1. Make sense of problems and persevere in solving them.
5. Use appropriate tools strategically.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Rationale: "The students know how to do the math. They just don't understand what the question is asking." (Miller, 2009) My students have difficulty solving story problems because they do not apply the reading skills to math class. SQ3R will help with comprehension and should help with students' understanding of story problems.

Materials:

Mission Space Jump article. Story Problems.

Procedures and approximate time allocated for each event

• Introduction to the lesson

Ask: "We have been talking about ways to truly comprehend what we are reading in a story problem. Yesterday we worked to incorporate graphic organizers into our math problems. Ms. Bailey said that she taught you something called SQ3R? What is that about? Could someone explain what this stands for?" I am looking for my students to tell me: "Survey, Question, Read, Recite, and Review."

Write SQ3R on the board and all correct comments from my students.

Ask: "While surveying, what should you be looking for?"

Write down responses under the “S” in SQ3R. I am looking for them to explain text features (title, subheading, picture, graphs).

Ask: “What does the Q tell you to do?”

Write down responses under the “Q” in SQ3R. I am looking for them to say Question and that they are to write down any questions that they have and turn any title or subheading into a question.

Ask: “While reading, is there anything else that you are to do besides read?”

Write down any responses under the “read”. I am looking for my students to say that they are to just read.

Ask: “What is to recite?”

Write down their response under the recite. I am looking for them to say that they are to answer any question that they had.

Ask: “And review is just to look back over the article, correct?”

This part should take **20 minutes**.

Say: “We are going to practice this method with this sky diver article. Please take your time. It should take you until the end of class. Make sure you are doing all of the steps of SQ3R. Tomorrow in math class I am going to look to see how much you remember from this article.” **(Rest of class)**

Pass out the article

1st Block Math Class

Say: “Yesterday you were asked to SQ3R the *Mission: Space Jump* article. On the back side I would like to ask you a few questions just to gauge how much you remember from your reading last night, and nope it is not for a grade. Please number on the back one through ten. To find questions please look in the assessment section of this lesson plan.

Read out each question.

Once you are finished go over the answers

Ask: “How did you all do? How much do you feel the SQ3R helped? Why do you think it helped?” Look at any positive response.

Ask: “Look at the answers that you got wrong. When you were using this strategy did you address what was asked in the question or did you get it wrong because while reading you missed noting it?” **(15 min)**

With the SQ3R still written on the board from yesterday, ask: "How could this strategy help us on math story problems?" Take any positive response that you get.

Ask: "What would we change to make this more applicable for math story problems?"

I want to hear any suggestions that they want to put forth, just as long as they give a reason for the change. I am looking for them to point out that they need to solve the problem and that it should happen before they do the final review. I would also accept any change to the text features and would push the discussion toward what text feature that they would find in the math problem. **(10 min)**

"I am now going to give you two math problems. I want you to use the SQ3R method before you solve these problems."

Pass out the two problems. Let them work until they are finished. Circle around to answer any questions. **(15min)**

Once they are finished, go over the answer with them.

Closing summary for the lesson

Say: "The last two days we have introduced two Language Arts strategies into math class. These strategies are here to help you understand what the question is asking. I know that all problems do not fit all strategies, and it is up to you to get comfortable with these and use them where you see fit."

• Transition to next learning activity

Assessment

I will first assess the understanding of the article with these questions:

- 1) Where is the Jumper from?
- 2) Where did he get his start?
- 3) Who paid for the jump?
- 4) How far did he fall?
- 5) When did this take place?
- 6) What was his nickname?
- 7) From what layer of the earth's atmosphere did he jump?
- 8) Where did this take place?
- 9) How long did he take to prepare?
- 10) What is the Sound Barrier?

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I will assess the application of SQ3R with my students ability to accurately answer story problems.
